CONSTRUCTED RESPONSE QUESTIONS

Q.1: Differentiate between physical and non-physical quantities with examples.

Ans: Physical quantities are measurable properties that can be expressed in terms of numbers and units. **Examples** include length, mass, time, temperature, and speed. These quantities are fundamental to physics and help describe the physical universe. For instance, the distance between two points can be measured in meters, and the time taken for an event can be measured in seconds., On the other hand, **non-physical quantities** are abstract concepts that cannot be measured or expressed in terms of units. These include emotions like happiness, sadness, and abstract ideas like honesty and courage. Such quantities do not have a physical existence and are subjective in nature., The distinction between the two lies in their applicability. Physical quantities are essential for scientific studies and practical applications, whereas non-physical quantities are related to human experiences and thoughts. For example, while the height of a person can be measured in centimetres (a physical quantity), their confidence cannot be quantified directly.

SHORT QUESTIONS WITH ANSWER

Q.1: Give two examples of non-physical quantities.

Ans: Love and happiness.

Q.2: What is the difference between physical and non-physical quantities?

Ans: Physical quantities can be measured, while non-physical quantities cannot.

Q.3: List three examples of physical quantities.

Ans: Length, mass, and time.

Q.4: Why is speed considered a physical quantity?

Ans: Because it can be measured and expressed in terms of units like meters per second (m/s).

Q.5: Define physical quantity.

Ans: A physical quantity is a measurable property of matter, expressed with a number and a unit.

Q.6: Define non-physical quantity.

Ans: Non-physical quantities are qualities or concepts, such as emotions or thoughts, which cannot be measured.

Q.7: Why are physical quantities important in physics?

Ans: They allow us to describe, analyze, and predict physical phenomena accurately.

MULTIPLE CHOICE QUESTIONS

1. What is an example of a physical quantity?
A) Happiness B) Length C) Honesty D) Courage

2. Which of the following is NOT a physical quantity?
A) Speed B) Anger C) Temperature D) Mass

3. Why is speed considered a physical quantity?
A) Because it is an abstract concept B) Because it cannot be measured
C) Because it can be measured D) Because it has no unit

4. Which of the following is a measurable quantity?
A) Speed B) Happiness C) Courage D) Anger

5. Non-physical quantities include:
A) Mass B) Honesty C) Velocity D) Distance

6. What does the measurement of a physical quantity include?
A) A number and a unit B) Only a unit
C) Only a number D) No measurement needed

7. Which of the following is a physical quantity?
A) Temperature B) Happiness C) Intelligence D) Love

8. Which of the following is a non-physical quantity?
A) Mass B) Length C) Speed D) Freedom

9. Which of the following is NOT a physical quantity?
A) Force B) Energy C) Time D) Joy

10. Which of the following is a characteristic of physical quantities?
A) They can be measured B) They are subjective
C) They vary with opinion D) They cannot be quantified

11. Which of the following is a characteristic of non-physical quantities?
A) They can be measured B) They are subjective
C) They have units D) They are objective

12. Which of the following is a physical quantity?
A) Speed B) Emotion
C) Temperature D) Both A and C

13. Which of the following is an example of a physical quantity?
A) Distance B) Happiness C) Wealth D) Knowledge

14. Which of the following is NOT a non-physical quantity?
A) Temperature B) Pressure C) Volume D) Energy

ANSWERS KEY

1	B	2	B	3	C	4	A	5	B
6	A	7	A	8	D	9	D	10	A
11	B	12	D	13	A	14	D		

1.2: Base and Derived Physical Quantities

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Explain the difference between base and derived quantities with examples and their significance in physics.

Ans: ***Base quantities*** are the fundamental building blocks of physics, defined by independent physical properties. There are seven base quantities in the SI system: length (meter), mass (kilogram), time (second), electric current (ampere), temperature (kelvin), amount of substance (mole), and luminous intensity (candela). These quantities are standardized and cannot be derived from other quantities.,

Derived quantities, on the other hand, are formed by combining base quantities through mathematical relationships. For example, velocity is derived by dividing distance (length) by time, with the unit m/s. Similarly, force is calculated as mass × acceleration with the unit Newton(N),

Base quantities provide a foundation for measurements, ensuring uniformity and consistency in scientific work. Derived quantities allow the study of more complex phenomena by combining basic concepts. For example, understanding force (a derived quantity) helps in analyzing motion, while energy (another derived quantity) explains work done in systems.

SHORT QUESTIONS WITH ANSWER

Q.1: What are base quantities? Give two examples.

Ans: Base quantities are fundamental quantities like length and mass.

Q.2: Name a derived physical quantity and its formula.

Ans: Velocity, formula: v=d/t

Q.3: Name the seven base quantities in the SI system.

Ans: Length, mass, time, electric current, temperature, amount of substance, and luminous intensity.

Q.4: How are derived quantities formed? Give two examples.

Ans: Derived quantities are formed by combining base quantities, e.g., area (length×width) and force is equal to (mass×acceleration).

Q.5: What is the unit of the derived quantity density?

Ans: Kilogram per cubic meter (kg/m^3).

Q.6: Define derived quantities.

Ans: Derived quantities are formed by combining base quantities through mathematical operations.

Q.7: Give two examples of derived quantities and their SI units.

Ans: Force (Newton, N) and velocity (meters per second, m/s).

MULTIPLE CHOICE QUESTIONS

1. Which of the following is a base quantity?
A) Area B) Time C) Velocity D) Force

2. Which of these is a derived physical quantity?
A) Mass B) Time C) Force D) Length

3. How many base quantities are there in the SI system?
A) Five B) Seven C) Nine D) Ten

4. Which of the following is NOT a base quantity?
A) Length B) Speed C) Mass D) Time

5. Force is an example of which type of quantity?
A) Base B) Derived
C) Non-physical D) Fundamental

6. What is the SI unit of the derived quantity velocity?
A) Kilograms per second B) Meters per second
C) Joules per meter D) Candela

7. How many base physical quantities are there in the SI system?
A) 5 B) 7 C) 10 D) 12

8. Which of the following is a derived quantity?
A) Length B) Mass C) Area D) Time

9. What is the base unit of mass in the SI system?
A) Kilogram B) Gram C) Pound D) Ounce

10. Which of the following is NOT a base quantity?
A) Temperature B) Electric current
C) Volume D) Length

11. Which of the following is a base quantity?
A) Volume B) Density C) Length D) Speed

12. What is the derived unit for velocity?
A) m/s B) m C) s D) m^2/s

13. Which of the following is a derived quantity?
A) Time B) Mass C) Force D) Length

14. What is the base unit for electric current in the SI system?
A) Ampere B) Volt C) Ohm D) Coulomb

ANSWERS KEY

1	B	2	C	3	B	4	B	5	B
6	B	7	B	8	C	9	A	10	C
11	C	12	A	13	C	14	A		

1.3: International System of Units

CONSTRUCTED RESPONSE QUESTIONS

Q.1: What is the International System of Units (SI), and why is it important? Discuss its base units.

Ans: The International System of Units (SI) is a globally recognized standard for measurements, ensuring consistency and uniformity in scientific, industrial, and everyday applications. It was established in 1960 and is based on seven base units:, 1. Meter (m): Unit of length., 2. Kilogram (kg): Unit of mass., 3. Second (s): Unit of time., 4. Ampere (A): Unit of electric current., 5. Kelvin (K): Unit of temperature., 6. Mole (mol): Unit of the amount of substance., 7. Candela (cd): Unit of luminous intensity.,

The SI system is important because it provides a universal framework for communication in science and technology. For example, without standard units, collaboration between researchers or industries across the globe would be challenging. Additionally, it ensures accuracy, precision, and reproducibility in experiments. The uniformity of SI units also facilitates education, trade, and regulatory compliance worldwide.

SHORT QUESTIONS WITH ANSWER

Q.1: State the SI unit for electric current.
Ans: Ampere (A).
Q.2: Why is the International System of Units important?
Ans: It provides a standard and uniform way of measurement across the world.
Q.3: State the SI unit of temperature.
Ans: Kelvin (K).
Q.4: What is the SI unit of luminous intensity?
Ans: Candela (cd).
Q.5: What does SI stand for?
Ans: SI stands for the International System of Units.
Q.6: Define SI unit.
Ans: SI unit is the standard unit of measurement defined under the International System of Units.
Q.7: Why do scientists use SI units?

Ans: To ensure consistency and uniformity in measurements worldwide.

MULTIPLE CHOICE QUESTIONS

1. What is the SI unit of length?
A) Kilogram B) Meter C) Second D) Candela

2. The SI unit for temperature is:
A) Kelvin B) Celsius C) Fahrenheit D) Joule

3. What does SI stand for?
A) Standard International Units B) International System of Units
C) Systematic International Units D) International Standards Units

4. The SI unit for luminous intensity is:
A) Kelvin B) Candela C) Mole D) Ampere

5. Which quantity is measured in amperes?
A) Electric current B) Length
C) Mass D) Temperature

6. What is the SI unit of amount of substance?
A) Mole B) Candela C) Liter D) Meter

7. What does SI stand for?
A) Standard International B) Systematic Integration
C) International System D) Scientific Index

8. Which of the following is the base unit for length in the SI system?
A) Meter B) Centimeter C) Kilometer D) Millimeter

9. What is the SI unit for time?
A) Second B) Minute C) Hour D) Day

10. Which of the following is the correct symbol for the unit of mass?
A) M B) Kg C) G D) L

11. What is the base unit for temperature in the SI system?
A) Kelvin B) Celsius C) Fahrenheit D) Rankine

12. Which of the following is NOT a base unit in the SI system?
A) Meter B) Kilogram C) Joule D) Second

13. What is the SI unit for luminous intensity?
A) Candela B) Lux C) Lumen D) Watt

14. Which of the following units is used for measuring frequency?
A) Hertz B) Joule C) Newton D) Pascal

ANSWERS KEY

1	**B**	**2**	**A**	**3**	**B**	**4**	**B**	**5**	**A**
6	**A**	**7**	**C**	**8**	**A**	**9**	**A**	**10**	**B**
11	**A**	**12**	**C**	**13**	**A**	**14**	**A**		

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Explain scientific notation with its advantages and examples.

Ans: Answer: Scientific notation is a way of expressing very large or very small numbers in a concise format. It represents a number as a product of a coefficient (between 1 and 10) and a power of 10. For example, the speed of light (300,000,000 m/s) can be written as 3×10^{8} m/s, and the size of an atom (0.0000000001 m) can be written as 1×10^{-10} m,

Advantages of scientific notation include:,

1. Simplicity: It simplifies calculations involving extreme values.,
2. Clarity: Large or small values are easier to read and interpret.,
3. Accuracy: Maintains significant figures, ensuring precise representation of data.,

Scientific notation is widely used in physics, chemistry, and astronomy to handle data efficiently. For example, the mass of the Earth (5.97×10^{24} kg) and the size of an electron (9.1×10^{-31} kg) are conveniently expressed using this method.

SHORT QUESTIONS WITH ANSWER

Q.1: Express 0.00034 in scientific notation.

Ans: 3.4×10^{-4}

Q.2: Write 6.02×10^{23} in standard form.

Ans: 6.02,000,000,000,000,000,000,000

Q.3: Write 0.00000082 in scientific notation.

Ans: 8.2 X 10^{-7}.

Q.4: Convert 4.57×10^{5} to standard form.

Ans: 457000

Q.5: Define scientific notation.

Ans: Scientific notation is a way of expressing very large or very small numbers as a product of a number between 1 and 10 and a power of 10.

Q.6: Convert 1250000 into scientific notation.

Ansa: 1.25×10^{6}

MULTIPLE CHOICE QUESTIONS

1. What is 0.00034 in scientific notation?

A) 3.4×10^{-5} B) 3.4×10^{-4} C) 3.4×10^{-3} D) 3.4×10^{-6}

2. Which of the following numbers is written in scientific notation?

A) 4.5×10^{4} B) 4.5×10^{3} C) 4.5×10^{5} D) 4.5×10^{2}

3. Why is scientific notation useful?
A) It adds precision B) It simplifies large and small numbers
C) It avoids errors D) It eliminates units

4. What is 3.2×10^{3} in standard form?
A) 3200 B) 0.0032 C) 0.00032 D) 32

5. Which of these numbers is the same as 5.1×10^{-3}?
A) 5100 B) 0.0051 C) 0.51 D) 0.00051

6. How is 10000 expressed in scientific notation?
A) 1×10^{3} B) 1×10^{4} C) 1×10^{5} D) 1×10^{2}

7. What is the scientific notation for 0.00045?
A) 4.5×10^{-4} B) 4.5×10^{4} C) 45×10^{-5} D) 45×10^{5}

8. How is 3000 expressed in scientific notation?
A) 3×10^{3} B) 30×10^{2} C) 0.3×10^{4} D) 300×10^{1}

9. Which of the following is NOT a valid scientific notation?
A) 1.2×10^{3} B) 0.5×10^{2} C) 5.0×10^{0} D) 10×10^{1}

10. What is the purpose of scientific notation?
A) To simplify large numbers B) To confuse readers
C) To eliminate decimals D) To increase complexity

11. How is 0.000123 expressed in scientific notation?
A) 1.23×10^{-4} B) 1.23×10^{-3}
C) 1.23×10^{-2} D) 1.23×10^{-5}

12. What is the scientific notation for 5000?
A) 5×10^{3} B) 50×10^{2} C) 0.5×10^{4} D) 500×10^{1}

13. Which of the following is a correct scientific notation?
A) 0.0034×10^{2} B) 3.4×10^{-3}
C) 34×10^{-4} D) 34×10^{0}

14. What is the scientific notation for 1,000,000?
A) 1×10^{6} B) 10×10^{5}
C) 100×10^{4} D) 0.1×10^{7}

ANSWERS KEY

1	**B**	**2**	**B**	**3**	**B**	**4**	**A**	**5**	**B**
6	**B**	**7**	**A**	**8**	**A**	**9**	**D**	**10**	**A**
11	**A**	**12**	**A**	**13**	**B**	**14**	**A**	**15**	

1.5: Length Measuring Instruments

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Describe the working of a Vernier caliper and its importance in length measurement.

Ans: The Vernier caliper is a precision instrument used to measure the dimensions of objects with high accuracy. It consists of two main scales:

1. **Main Scale:** A fixed scale marked in millimeters or centimeters.,
2. **Vernier Scale:** A movable scale that slides along the main scale.,

The Vernier caliper has two jaws: External Jaws: Measure the external dimensions of an object., Internal Jaws: Measure the internal dimensions like the diameter of a hole., Depth Rod: Measures the depth of a cavity or hole.,

Working: 1. Place the object between the appropriate jaws.,
2. Slide the Vernier scale until it fits snugly around the object.,
3. Note the main scale reading before the zero mark of the Vernier scale.,
4. Find the Vernier scale mark that aligns perfectly with a mark on the main scale.,
5. Add these readings to get the total measurement., For example, if the main scale reads 2.3 cm and the Vernier scale alignment adds 0.05 cm, the total measurement is 2.35 cm, The least count (typically 0.01 cm) makes the Vernier caliper ideal for precise measurements, such as in mechanical or laboratory applications.

SHORT QUESTIONS WITH ANSWER

Q.1: Which instrument is used to measure the length of a curved object?
Ans: A measuring tape.
Q.2: What is the least count of a Vernier caliper?
Ans: 0.01 cm.
Q.3: Which instrument is best for measuring the diameter of a thin wire?
Ans: A micrometer screw gauge.
Q.4: What is the principle of a Vernier caliper?
Ans: It uses two scales (main scale and Vernier scale) to measure lengths more precisely.
Q.5: Define least count.
Ans: The least count is the smallest value that can be measured accurately with an instrument.

Q.6: What is the least count of a micrometer screw gauge?
Ans: 0.01 mm.
Q.7: Name an instrument used for measuring very long distances.
Ans: Measuring tape or a laser rangefinder.

MULTIPLE CHOICE QUESTIONS

1. What is the least count of a Vernier caliper?
A) 0.01 cm B) 0.1 cm C) 1.0 cm D) 0.001 cm

2. Which instrument is best for measuring the diameter of a wire?
A) Vernier caliper B) Micrometer screw gauge
C) Measuring tape D) Ruler

3. Which of the following measures the length of a curved object?
A) Vernier caliper B) Ruler
C) Measuring tape D) Digital scale

4. Which of the following is used to measure the depth of an object?
A) Measuring tape B) Depth rod
C) Ruler D) Digital balance

5. What is the primary use of a Vernier caliper?
A) Measuring weight
B) Measuring small lengths with precision
C) Measuring time D) Measuring temperature

6. How is the least count of a measuring instrument determined?
A) By dividing the smallest scale division by total divisions
B) By multiplying main and Vernier readings
C) By subtracting zero error D) By averaging measurements

7. Which instrument is commonly used to measure length?
A) Ruler B) Thermometer
C) Barometer D) Stopwatch

8. What is the smallest division on a standard ruler?
A) 0.1 cm B) 0.01 cm C) 1 mm D) 0.5 cm

9. Which of the following is used for measuring longer distances?
A) Caliper B) Tape measure C) Micrometer D) Protractor

10. What is the primary unit of length in the SI system?
A) Meter B) Foot C) Inch D) Yard

11. Which instrument is best for measuring small lengths accurately?
A) Ruler B) Vernier caliper
C) Tape measure D) Yardstick

12. What is the main advantage of using a micrometer screw gauge?
A) Measures large lengths
B) Measures small lengths with high precision

C) Measures weight D) Measures temperature

13. Which of the following is NOT a tool for measuring length?

A) Caliper B) Ruler

C) Stopwatch D) Measuring tape

14. What is the typical range of a standard tape measure?

A) 1 meter B) 5 meters C) 10 meters D) 30 meters

ANSWERS KEY

1	**A**	**2**	**B**	**3**	**C**	**4**	**B**	**5**	**B**
6	**A**	**7**	**A**	**8**	**C**	**9**	**B**	**10**	**A**
11	**B**	**12**	**B**	**13**	**C**	**14**	**D**		

1.6: Mass Measuring Instruments

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Explain the principle and types of mass measuring instruments.

Ans: Mass measuring instruments are devices used to determine the amount of matter in an object. The principle of these instruments depends on comparing the unknown mass with a standard reference mass or measuring the force exerted by gravity on the object.,

Types of Instruments: 1. Beam Balance: Compares the unknown mass with standard weights using a balance beam. It is commonly used in traditional setups for high accuracy.

2. Digital Balance: Uses electronic sensors to provide highly precise measurements, ideal for laboratories.,

3. Spring Balance: Measures the weight (force due to gravity) and converts it to mass using the relation Weight=Mass × Gravity It is suitable for everyday use, such as measuring groceries.,

4. Analytical Balance: Offers the highest precision, often used in chemistry labs to measure very small masses (e.g., milligrams)., Mass measurement is critical in science, commerce, and industry to ensure consistency and accuracy in processes.

SHORT QUESTIONS WITH ANSWER

Q.1: Name an instrument used to measure mass accurately in a laboratory.

Ans Digital balance.

Q.2: Which device is used to measure the mass of a heavier object?

Ans: A spring balance.

Q.3: What is the least count of a digital balance?
Ans: Typically 0.01 g or less, depending on the balance.
Q.4: How is mass different from weight?
Ans: Mass is the amount of matter in an object, while weight is the force exerted by gravity on the mass.
Q.5: Which balance is used for very small and precise measurements of mass?
Ans: An analytical balance.
Q.6: Define mass.
Ans: Mass is the amount of matter contained in an object.
Q.7: What is the function of a spring balance?
Ans: It measures the weight of an object, which can be converted into mass.

MULTIPLE CHOICE QUESTIONS

1. What is the unit of mass in the SI system?
A) Gram B) Kilogram C) Newton D) Pound

2. Which instrument is used to measure very small masses?
A) Spring balance B) Beam balance
C) Analytical balance D) Bathroom scale

3. How does a spring balance measure mass?
A) By direct comparison
B) By measuring weight and dividing by gravity
C) By vibration of a spring D) By measuring volume

4. What is the principle of a digital balance?
A) Comparing weights B) Electronic sensors measure mass
C) Using spring deflection D) Using a balance beam

5. Which device is best for measuring heavy objects?
A) Digital balance B) Spring balance
C) Analytical balance D) Micrometer

6. What happens if a beam balance is not calibrated correctly?
A) Random error occurs B) Systematic error occurs
C) Zero error occurs D) No error occurs

7. Which instrument is used to measure mass?
A) Scale B) Ruler
C) Stopwatch D) Thermometer

8. What is the SI unit of mass?
A) Kilogram B) Gram C) Pound D) Ounce

9. Which of the following is a balance used for measuring mass?
A) Spring balance B) Digital balance
C) Beam balance D) All of the above

10. What is the smallest mass that can be measured on a standard balance?
A) 0.1g B) 1g C) 0.01g D) 0.001 g

11. Which type of balance is most accurate for measuring mass?

A) Spring balance B) Beam balance
C) Digital balance D) Mechanical balance

12. What is the purpose of a balance?
A) To measure length B) To measure mass
C) To measure time D) To measure volume

13. Which of the following is a common error when using a balance?
A) Calibration error B) Zero error
C) Reading error D) All of the above

14. What is the unit of mass in the CGS system?
A) Kilogram B) Gram C) Milligram D) Pound

ANSWERS KEY

1	**B**	**2**	**C**	**3**	**C**	**4**	**B**	**5**	**B**
6	**B**	**7**	**A**	**8**	**A**	**9**	**D**	**10**	**D**
11	**C**	**12**	**B**	**13**	**D**	**14**	**B**		

1.7: Time Measuring Instruments

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Discuss the evolution of time-measuring instruments and their significance.

Ans: Time measurement has evolved significantly, from ancient methods to modern precision instruments.,

Ancient Instruments:, 1. Sundials: Used the shadow of the sun to indicate the time of day., 2. Water Clocks: Measured time by the flow of water between two containers., 3. Hourglasses: Used sand flowing through a narrow neck to measure time intervals.,

Modern Instruments:, 1. Mechanical Clocks: Use a system of gears and springs to measure time., 2. Quartz Clocks: Employ the vibration of a quartz crystal to provide accurate timekeeping., 3. Digital Clocks: Display time electronically using LEDs or LCDs., 4. Atomic Clocks: Measure time with unmatched precision, based on the vibrations of cesium or rubidium atoms., Time measurement is essential in everyday life, scientific experiments, and industries like transportation, where precise scheduling is critical.

SHORT QUESTIONS WITH ANSWER

Q.1: What is the SI unit of time?

Ans: Second (s).

Q.2: Which instrument is used to measure time
Ans: A stopwatch.
Q.3: What is the function of a pendulum clock?
Ans: It measures time based on the regular swinging of a pendulum.
Q.4: How is time measured in ancient sundials?
Ans: By observing the shadow cast by the sun on a marked surface.
Q.5: Define time.
Ans: Time is the duration of an event or the interval between two events.
Q.6: What is the most accurate time measuring instrument today?
Ans: Atomic clock.
Q.7: Name an instrument used to measure time to the nearest millisecond.
Ans: Atomic clock.

MULTIPLE CHOICE QUESTIONS

1. What is the SI unit of time?
A) Hour B) Minute
C) Second D) Millisecond

2. Which instrument is used to measure very short time intervals?
A) Pendulum clock B) Sundial
C) Stopwatch D) Mechanical clock

3. What is the most accurate time-measuring instrument?
A) Digital clock B) Quartz clock
C) Atomic clock D) Sundial

4. Which ancient instrument measures time based on the sun's shadow?
A) Water clock B) Hourglass
C) Sundial D) Pendulum

5. Which clock uses the vibration of quartz crystals to measure time?
A) Mechanical clock B) Quartz clock
C) Atomic clock D) Digital stopwatch

6. What property of an atomic clock ensures its accuracy?
A) Stable frequency of atomic vibrations B) The shape of the clock
C) The use of a pendulum D) The material of the clock

7. Which instrument is used to measure time?
A) Stopwatch B) Ruler C) Thermometer D) Barometer

8. What is the SI unit of time?
A) Second B) Minute C) Hour D) Day

9. Which of the following is a common time-measuring device?
A) Clock B) Ruler C) Scale D) Protractor

10. What is the smallest unit of time commonly used?
A) Millisecond B) Microsecond
C) Second D) Nanosecond

11. Which device is used to measure very short time intervals?

A) Stopwatch B) Clock
C) Timer D) Chronometer

12. What is the main function of a sundial?
A) To measure time using shadows B) To measure temperature
C) To measure time using shadows D) To measure temperature

13. Which of the following is NOT a time-measuring device?
A) Hourglass B) Stopwatch C) Ruler D) Clock

14. What is the accuracy of a typical quartz clock?
A) ±1 second per day B) ±1 second per week
C) ±1 second per month D) ±1 second per year

ANSWERS KEY

1	**C**	**2**	**C**	**3**	**C**	**4**	**C**	**5**	**B**
6	**A**	**7**	**A**	**8**	**A**	**9**	**A**	**10**	**A**
11	**D**	**12**	**B**	**13**	**C**	**14**	**A**		

1.8: Volume Measuring Instruments

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Describe the methods and instruments used to measure the volume of solids and liquids.

Ans: The volume of an object is the space it occupies, measured in cubic meters (m3) for solids and litters (L) for liquids.,

For Liquids:, 1. Measuring Cylinder: A graduated cylinder used to measure liquid volume directly., 2. Burette and Pipette: Precision instruments used in laboratories for titrations and transferring liquids.,

For Solids: 1. Regular Shapes: The volume is calculated using mathematical formulas. For example, the volume of a sphere is $4/3\pi r^3$, 2. Irregular Shapes: The volume is measured using the water displacement method. The object is submerged in water, and the rise in water level gives its volume., Accurate volume measurements are crucial in industries like manufacturing, chemical processes, and fluid dynamics.

SHORT QUESTIONS WITH ANSWER

Q.1: Name an instrument used to measure liquid volume.
Ans: Measuring cylinder.
Q.2: What is the standard unit of volume?
Ans: Cubic meter (m^3).
Q.3: What is the purpose of a burette in volume measurements?

Ans: It measures precise volumes of liquid, especially in titrations.

Q.4: How is the volume of an irregular solid object measured?

Ans: By submerging it in water and measuring the displaced volume.

Q.5: Name a device used to measure the volume of gases.

Ans: A gas syringe or a gas meter.

Q.6: Define volume.

Ans: Volume is the amount of space occupied by an object or substance.

Q.7: How can the volume of a regular-shaped object be calculated?

Ans: By using the formula for the object's geometry, e.g.,

Volume of a cube=One Side of Cube X Second Side of Cube X Third Side of Cube = $Side^3$

Q.7: Which device is used to measure small volumes of liquids accurately?

Ans: A burette or pipette.

MULTIPLE CHOICE QUESTIONS

1. Which instrument measures liquid volume accurately?

A) Measuring tape B) Measuring cylinder
C) Pipette D) Ruler

2. What is the standard unit of volume?

A) Liter B) Cubic meter
C) Milliliter D) Square meter

3. How is the volume of an irregular solid measured?

A) By water displacement method B) By measuring its dimensions
C) By using a ruler D) By observing its shadow

4. A graduated cylinder is used to measure:

A) Mass of liquids B) Volume of liquids
C) Length of solids D) Time intervals

5. What is the best method to measure the volume of an irregular solid?

A) Measuring its surface area B) Displacement of water
C) Using a pipette D) Measuring its length and breadth

6. Which instrument is most commonly used in laboratories to measure liquid volumes?

A) Pipette B) Measuring tape
C) Burette D) Ruler

7. Which instrument is used to measure the volume of liquids?

A) Graduated cylinder B) Ruler
C) Scale D) Stopwatch

8. What is the SI unit of volume?

A) Liter B) Cubic meter
C) Gallon D) Milliliter

9. Which of the following is used to measure the volume of irregular objects?

A) Graduated cylinder B) Overflow can

C) Ruler D) Beaker

10. What is the volume of 1 cubic meter in liters?

A) 1000 L B) 1 L C) 10 L D) 100 L

11. Which instrument is best for measuring the volume of a solid object?

A) Graduated cylinder B) Beaker

C) Overflow can D) Ruler

12. What is the volume of 500 mL in liters?

A) 0.5 L B) 5 L C) 50 L D) 500 L

13. Which of the following is used to measure the volume of gases?

A) Graduated cylinder B) Manometer

C) Beaker D) Overflow can

14. What is the volume of a cube with a side length of 2 cm?

A) 4 cm^3 B) 6 cm^3 C) 8 cm^3 D) 10 cm^3

ANSWERS KEY

1	**B**	**2**	**B**	**3**	**A**	**4**	**B**	**5**	**B**
6	**C**	**7**	**A**	**8**	**B**	**9**	**B**	**10**	**A**
11	**C**	**12**	**A**	**13**	**B**	**14**	**C**		

CONSTRUCTED RESPONSE QUESTIONS

Q.1: What are the causes of errors in measurements, and how can they be minimized?

Ans: Errors in measurements arise due to limitations in instruments, observer mistakes, or environmental factors.,

Causes: 1. Instrumental Errors: Faulty or poorly calibrated instruments, such as a misaligned scale.,

2. Human Errors: Misreading a scale or recording data incorrectly.,

3. Environmental Factors: Changes in temperature, pressure, or humidity affecting the measurement.,

Types of Errors: 1. Random Errors: Unpredictable and vary with each measurement.,

2. Systematic Errors: Consistent errors due to fixed inaccuracies.,

Minimization Techniques: 1. Calibrate instruments regularly.,

2. Repeat measurements and take the average to reduce random errors.

3. Use more precise instruments.

4. Train observers to minimize human errors.,

Minimizing errors is essential to ensure reliable and accurate results in scientific and practical applications.

SHORT QUESTIONS WITH ANSWER

Q.1: What is the base unit for electric current in the SI system?

Ans: Ampere

Q.2: What is meant by a systematic error?

Ans: A systematic error is consistent and occurs due to faulty equipment or methods.

Q.3: What causes random errors in measurements?

Ans: Unpredictable variations, such as changes in environmental conditions.

Q.4: How can systematic errors be corrected?

Ans: By recalibrating instruments or improving measurement techniques.

Q.5: What is a human error in measurements? Give an example.

Ans: Mistakes made by the observer, e.g., misreading the scale.

Q.6: Define random error.

Ans: Random error is an unpredictable error that occurs due to variations in measurements.

Q.7: Define systematic error.

Ans: Systematic error is a consistent error caused by faulty equipment or incorrect methods.

Q.8: What is zero error?

Ans: Zero error occurs when an instrument does not show zero when it should, leading to incorrect readings.

Q.9: Define errors in measurements and discuss their types with examples.

Ans: Errors in measurements refer to the difference between the measured value and the true value. No measurement is entirely free from errors due to limitations in instruments, observers, or environmental factors.,

Types of Errors:,

1. Random Errors: These occur unpredictably due to fluctuations in measurement conditions, such as temperature or pressure. For instance, using a thermometer repeatedly may give slightly different readings.,
2. Systematic Errors: These are consistent and repeatable, caused by faulty instruments or incorrect methods. For example, if a weighing scale shows 0.1 kg when empty, all measurements will have this error.,
3. Zero Errors: Occur when an instrument does not read zero when no input is applied. For instance, a Vernier calliper with a non-zero initial reading will introduce error in all measurements., Errors can be minimized by calibrating instruments, improving experimental techniques, and taking repeated measurements to average out inaccuracies.

MULTIPLE CHOICE QUESTIONS

1. What is a random error?

A) An error due to faulty instruments

B) An unpredictable variation in measurements

C) A consistent error D) A zero error

2. What causes systematic errors?

A) Random environmental changes B) Faulty instruments

C) Careless observations D) Unstable temperature

3. Which type of error occurs due to human mistakes?

A) Systematic error B) Random error

C) Human error D) Zero error

4. What type of error occurs due to environmental factors?

A) Systematic error B) Random error

C) Human error D) Zero error

5. Which of the following is a zero error?

A) An unpredictable error

B) An instrument not showing zero when it should

C) A human mistake in observation

D) A consistent deviation in measurement

6. Why are repeated measurements important?

A) To make calculations easier B) To reduce random errors

C) To increase systematic errors D) To increase precision

7. What is a systematic error?

A) An error that occurs randomly B) An error that is consistent

C) An error that cannot be measured D) An error that is negligible

8. Which of the following is an example of a random error?

A) Calibration error B) Reading error

C) Instrument error D) Zero error

9. What is the main cause of human error in measurements?

A) Instrument malfunction B) Misreading the scale

C) Environmental factors D) Calibration

10. Which type of error can be reduced by repeated measurements?

A) Systematic error B) Random error

C) Instrument error D) Zero error

11. What type of error is caused by faulty equipment?

A) Systematic error B) Random error

C) Human error D) Environmental error

12. Which of the following can help minimize measurement errors?

A) Using calibrated instruments
B) Ignoring environmental conditions C) Taking a single measurement
D) Using outdated equipment

13. What is the effect of a zero error in a measuring instrument?
A) It increases accuracy B) It decreases precision
C) It shifts all measurements by a constant amount D) It has no effect

14. Which type of error is unpredictable and varies from one measurement to another?
A) Systematic error B) Random error
C) Instrument error D) Human error

ANSWERS KEY

1	**B**	**2**	**B**	**3**		**4**		**5**	**B**
6	**B**	**7**	**B**	**8**	**B**	**9**	**B**	**10**	
11	**A**	**12**	**A**	**13**	**C**	**14**		**15**	

SHORT QUESTIONS WITH ANSWER

Q.1: Define uncertainty in a measurement.
Ans: Uncertainty is the doubt about the exactness of a measurement.
Q.2: How can uncertainty be minimized?
Ans: By repeating the measurements and averaging the results.
Q.3: How is uncertainty represented in a measurement?
Ans: It is shown as ± a value, e.g., 5.0 ±0.15.0, pm 0.15.0±0.1.
Q.4: What is the main source of uncertainty in measurement?
Ans: Limitations in the measuring instrument and the observer's skill.
Q.5: How does repeating measurements help reduce uncertainty?
Ans: It averages out random errors.
Q.6: What is the purpose of stating uncertainty in measurements?
Ans: To indicate the confidence level in the accuracy of the measurement.
Q.7: How is uncertainty calculated?
Ans: By analyzing the range of repeated measurements or the instrument's precision.

MULTIPLE CHOICE QUESTIONS

1. How is uncertainty represented?

A) As a percentage B) As ± a value
C) As an average D) As a ratio

2. How can uncertainty be minimized?
A) By measuring once
B) By using digital instruments
C) By repeating measurements and averaging D) By changing the unit

3. What does uncertainty in measurement depend on?
A) The environment B) The precision of the measuring instrument
C) The observer's skill D) The calibration of the instrument

4. How is uncertainty represented in experimental results?
A) As a single value B) As a range or error margin
C) As a ratio D) As a fraction

5. What does uncertainty in measurement refer to?
A) The exact value B) The range of possible values
C) The average value D) The minimum value

6. Which of the following is a common way to express uncertainty?
A) As a percentage B) As a whole number
C) As a fraction D) As a decimal

7. What is the uncertainty of a measurement of 5.0 cm?
A) ±0.1 cm B) ±0.5 cm C) ±1 cm D) ±0.01 cm

8. Which factor does NOT affect measurement uncertainty?
A) Instrument precision B) User skill
C) Environmental conditions D) Measurement time

9. What is the formula for calculating uncertainty?
A) (Max value - Min value) / 2 B) Max value + Min value
C) Max value - Min value D) (Max value + Min value) / 2

10. Which of the following statements is true about uncertainty?
A) It can be eliminated completely
B) It is always present in measurements
C) It only occurs in scientific measurements
D) It is not important in measurements

11. What is the uncertainty of a measurement of 10.0 m?
A) ±0.1 m B) ±0.5 m C) ±1 m D) ±0.01 m

12. Which of the following factors can increase measurement uncertainty?
A) Using high-quality instruments B) Environmental stability
C) User experience D) Instrument calibration

ANSWERS KEY

1	**B**	**2**	**C**	**3**	**B**	**4**	**B**	**5**	**B**
6	**A**	**7**	**A**	**8**	**D**	**9**	**D**	**10**	**A**
11	**B**	**12**	**A**						

CONSTRUCTED RESPONSE QUESTIONS

Q.1: What are significant figures, and why are they important in measurements? Explain with examples.

Ans: Significant figures are the digits in a number that carry meaningful information about its precision. These include all non-zero digits, any zeros between significant digits, and trailing zeros in a decimal number., For example:, In 123.45, there are five significant figures., In 0.0078, there are two significant figures (7 and 8)., In 1000.0 there are five significant figures (including the decimal point).,

Importance: Significant figures are important because they reflect the precision of a measurement and the reliability of an instrument. For instance, a result expressed as 4.56 m indicates higher precision than 4.5 m., When performing calculations, the number of significant figures in the result should not exceed the least precise value in the inputs. For example, multiplying 2.1 (2 significant figures) by 3.456 (4 significant figures) gives 7.3 (2 significant figures)., Understanding significant figures helps scientists and engineers ensure the accuracy and reliability of their results.

SHORT QUESTIONS WITH ANSWER

Q.1: How many significant figures are in 0.00450?

Ans: Three.

Q.2: State the rule for identifying significant figures in a whole number without a decimal.

Ans: All non-zero digits are significant.

Q.3: Why are significant figures important?

Ans: They reflect the precision of a measurement.

Q.4: Identify the significant figures in 0.007800.

Ans: Four.

Q.5: How are significant figures determined in a multiplication operation?

Ans: The result should have as many significant figures as the least precise factor.

Q.6: Define significant figures.

Ans: Significant figures are the digits in a measurement that are known accurately, plus one estimated digit.

Q.7: How many significant figures are in 7000.0?
Ans: Five.
Q.8: What is the significance of zeros in significant figures?
Ans: Zeros between non-zero digits and at the end of a decimal number are significant.

MULTIPLE CHOICE QUESTIONS

1. How many significant figures are in 0.0045?
A) Two B) Three C) Four D) Five

2. What is the purpose of significant figures?
A) To reduce errors
B) To reflect measurement precision
C) To avoid complex calculations D) To increase speed

3. Which of the following has four significant figures?
A) 0.00456 B) 0.0456 C) 0.0456 D) 0.0045

4. Which rule applies when zeros are between non-zero digits?
A) Zeros are not significant B) Zeros are significant
C) Zeros are ignored D) Zeros are doubled

5. How many significant figures are in the number 0.00456?
A) 2 B) 3 C) 4 D) 5

6. Which of the following numbers has the most significant figures?
A) 100 B) 100 C) 1 D) 0.001

7. What is the rule for counting significant figures in a number?
A) Ignore leading zeros B) Count all digits
C) Ignore trailing zeros D) Count only whole numbers

8. In the number 123.450, how many significant figures are there?
A) 5 B) 6 C) 4 D) 3

9. How many significant figures are in the number 100.0?
A) 2 B) 3 C) 4 D) 5

10. Which of the following numbers has the least significant figures?
A) 0.0045 B) 45 C) 450 D) 4.5

11. In the number 0.00789, how many significant figures are there?
A) 2 B) 3 C) 4 D) 5

12. What is the rule for significant figures in multiplication?
A) Count all digits
B) Use the least number of significant figures
C) Use the most number of significant figures
D) Ignore zeros

ANSWERS KEY

1	**B**	**2**	**B**	**3**	**B**	**4**	**B**	**5**	**B**
6	**A**	**7**	**A**	**8**	**B**	**9**	**C**	**10**	**C**
11	**B**	**12**	**B**						

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Differentiate between precision and accuracy with examples.

Ans: Precision and accuracy are key aspects of measurements but differ significantly., Precision: Refers to the consistency of repeated measurements. If multiple measurements of an object's length are 5.01 cm,5.00 cm, 5.02cm, they are precise because they are close to each other. However, they may not be accurate if the actual length is 5.10 cm, Accuracy: Refers to how close a measurement is to the actual value. A single measurement of 5.10 cm is accurate if the true length is 5.10 cm, Comparison: Precision ensures consistency but does not guarantee accuracy., Accuracy ensures correctness but does not imply precision., Both precision and accuracy are crucial in experiments to ensure valid and reproducible results.

SHORT QUESTIONS WITH ANSWER

Q.1: Define precision in measurement.

Ans: Precision refers to the closeness of repeated measurements.

Q.2: What is accuracy in measurement?

Ans: Accuracy refers to how close a measurement is to the actual value.

Q.3: Which is better for scientific experiments: precision or accuracy? Why?

Ans: Both are important; precision ensures consistent results, and accuracy ensures correctness.

Q.4: What does low precision but high accuracy indicate?

Ans: Measurements are close to the actual value but vary widely.

Q.5: What is the difference between precision and accuracy?

Ans: Precision refers to consistency, while accuracy refers to correctness.

MULTIPLE CHOICE QUESTIONS

1. What does precision refer to?

A) Closeness to true value

B) Consistency of measurements

C) Rounding off measurements

D) Avoiding errors

2. Which term describes closeness to the actual value?
A) Precision B) Accuracy
C) Error D) Certainty

3. Which of these measurements is precise but not accurate?
A) 2.01 cm, 2.02 cm, 2.00 cm (actual value: 2.10 cm)
B) 2.10 cm, 2.15 cm, 2.05 cm (actual value: 2.10 cm)
C) 2.08 cm, 2.10 cm, 2.11 cm (actual value: 2.10 cm)
D) None

4. What does precision refer to in measurements?
A) Closeness to the true value
B) Consistency of repeated measurements C) Average of measurements
D) Range of measurements

5. Which of the following describes accuracy?
A) Consistency B) Closeness to the true value
C) Repeatability D) Range

6. If a set of measurements is very close to each other but far from the true value, they are:
A) Accurate B) Precise C) Both D) Neither

7. What is the ideal scenario for measurements?
A) High precision, low accuracy B) Low precision, high accuracy
C) High precision, high accuracy D) Low precision, low accuracy

8. If measurements are consistently close to the true value, they are:
A) Accurate B) Precise C) Both D) Neither

9. Which of the following describes a precise measurement?
A) Close to the true value B) Consistent results
C) Varying results D) Average of results

10. What is the difference between precision and accuracy?
A) Precision is about closeness; accuracy is about consistency
B) Precision is about consistency; accuracy is about closeness
C) They are the same
D) Precision is irrelevant; accuracy is key

11. Which scenario represents high precision but low accuracy?
A) All measurements are the same but far from the true value
B) Measurements are close to the true value
C) Measurements vary widely but average to the true value
D) All measurements are accurate

ANSWERS KEY

1	**B**	**2**	**B**	**3**	**A**	**4**	**B**	**5**	**B**
6	**B**	**7**	**B**	**8**	**A**	**9**	**B**	**10**	**B**
11	**A**								

CONSTRUCTED RESPONSE QUESTIONS

Q.1: Explain the rules of rounding off digits with examples. Why is rounding off important in measurements?

Ans: Rounding off is the process of simplifying a number to make it more concise while retaining its approximate value. This is done by reducing the number of digits, typically after a decimal point, according to specific rules., ***Rules for Rounding Off:***

1. If the digit to the right of the rounding place is less than 5, the last retained digit remains the same., Example: Rounding 4.732 to two decimal places gives 4.73,
2. If the digit to the right of the rounding place is 5 or greater, the last retained digit is increased by 1., Example: Rounding 4.736 to two decimal places gives 4.74,
3. If rounding off involves a whole number with no decimal point, trailing zeros may be added for clarity., Example: Rounding 3582 to the nearest hundred gives 3600,
4. If the digit being dropped is exactly 5 and no other digits follow, the last retained digit is rounded to the nearest even number (tie-breaking rule)., Example: Rounding 2.25 to one decimal place gives 2.2 while 2.35 rounds to 2.4,

Importance of Rounding Off:

1. Simplification: It reduces the complexity of large or small numbers, making them easier to interpret. For instance, instead of 3.14159265, we often use 3.14 for π,
2. Consistency: Rounding ensures uniformity in data presentation, especially in tables or graphs.,
3. Practicality: Measuring instruments often cannot provide infinite precision, so rounding aligns results with realistic measurement capabilities.

SHORT QUESTIONS WITH ANSWER

Q.1: Round off 3.546 to two decimal places.

Ans: 3.55.

Q.2: What is the rule for rounding off a number when the digit to the right is less than 5?

Ans: The last retained digit remains unchanged.

Q.3: Round off 56.987 to two significant figures.

Ans: 57

Q.4: What is the rule for rounding off when the digit to the right is exactly 5?

Ans: Round up the last retained digit if it is odd; leave it unchanged if even.

Q.5: Round off 0.006732 to three decimal places.

Ans: 0.007.

Q.6: Define rounding off.

Ans: Rounding off is the process of reducing the number of digits in a number while retaining its value close to the original.

Q.7: Round off 0.007856 to three decimal places.

Ans: 0.00786.

Q.8: Why is rounding off important?

Ans: It simplifies calculations and helps in presenting data concisely.

Q.9: Round off 4.445 to two significant figures.

Ans: 4.4.

MULTIPLE CHOICE QUESTIONS

1. What is 4.236 rounded off to two decimal places?

A) 4.234.234.23 B) 4.244.244.24
C) 4.254.254.25 D) 4.24.24.2

2. What is the rule for rounding off when the next digit is less than 5?

A) The last digit increases by 1 B) The last digit decreases by 1
C) The last digit remains the same D) The entire number changes

3. What is 345.78 rounded to the nearest whole number?

A) 345 B) 346 C) 347 D) 340

4. When rounding 1.2345 to three decimal places, what is the result?

A) 1.234 B) 1.235 C) 1.231 D) 1.24

5. What is the rule for rounding off 2.678 to two decimal places?

A) 2.67 B) 2.68 C) 2.7 D) 2.6

6. When rounding off 4.5 to the nearest whole number, what is the result?

A) 4 B) 5 C) 6 D) 4.5

7. How do you round off 0.049 to two decimal places?

A) 0.04 B) 0.05 C) 0.06 D) 0

8. What is the result of rounding 3.14159 to three decimal places?

A) 3.14 B) 3.142 C) 3.141 D) 3.15

9. When rounding off 5.678 to two decimal places, what is the result?

A) 5.67 B) 5.68 C) 5.7 D) 5.69

10. How do you round off 0.999 to one decimal place?

A) 0.9 B) 1 C) 1.1 D) 0.99

11. What is the result of rounding 7.456 to one decimal place?

A) 7.4 B) 7.5 C) 7.6 D) 7.45

ANSWERS KEY

1	D	2	C	3	B	4	A	5	B
6	B	7	B	8	B	9	B	10	A
11	B								

SOLVED EXERCISE

CONSTRUCTED RESPONSE QUESTIONS

Q.1: In what unit will you express each of the following?

Ans: Units for Measurement

(a) **Thickness of a five-rupee coin:**

- Millimeters (mm)

(b) **Length of a book:**

- Centimeters (cm) or meters (m)

(c) **Length of a football field:**

- Meters (m)

(d) **The distance between two cities:**

- Kilometers (km)

(e) **Mass of five-rupee coin:**

- Grams (g)

(f) **Mass of your school bag:**

- Kilograms (kg)

(g) **Duration of your class period:**

- Minutes (min) or hours (h)

(h) **Volume of petrol filled in the tank of a car:**

- Liters (L)

(i) **Time to boil one liter of milk:**

- Minutes (min) or seconds (s)

Q.2: Why might a standard system of measurement be helpful to a tailor?

Ans: A standard system of measurement helps tailors ensure that clothing fits properly. By using consistent units like centimeters or inches, tailors can accurately measure fabric and body dimensions, leading to well-fitted garments. This avoids confusion and mistakes when taking measurements for different clients.

Q.3: The minimum main scale reading of a micrometer screw gauge is 1 mm and there are 100 divisions on the circular scale. What is the least count of the instrument?

Ans: The least count of the micrometer screw gauge is calculated by dividing the smallest main scale reading by the number of divisions on the circular scale. Here, it is 1 mm / 100 = 0.01 mm. This means the instrument can measure lengths with a precision of 0.01 mm.

Q.4: You are provided a meter scale and a bundle of pencils; how can the diameter of a pencil be measured using the meter scale with the same precision as that of Vernier Calipers? Describe briefly.

Ans: To measure the diameter of a pencil using a meter scale, place the pencil horizontally on a flat surface. Align the scale next to the pencil and use a ruler to measure the width at the widest point. For precision, take multiple readings at different angles and average them to ensure accuracy, similar to using Vernier Calipers.

Q.5: The end of a meter scale is worn out. Where will you place a pencil to find the length?

Ans: If the end of a meter scale is worn out, place the pencil at the beginning of the scale (0 cm mark) and measure from there. Ensure the pencil is straight and aligned with the scale to get an accurate reading of its length.

Q.6: Why is it better to place the object close to the meter scale?

Ans: Placing the object close to the meter scale reduces parallax error, which occurs when the measurement is viewed from an angle. This ensures a more accurate reading, as the scale's markings are clearer and easier to align with the object's edge.

Q.7: Why is a standard unit needed to measure a quantity correctly?

Ans: A standard unit is essential for consistency and clarity in measurements. It allows people to communicate measurements effectively without confusion. For example, using meters for length ensures everyone understands the same distance, facilitating trade, science, and daily activities.

Q.8: Suggest some natural phenomena that could serve as a reasonably accurate time standard.

Ans: Natural phenomena that can serve as time standards include the Earth's rotation (day and night cycle), the lunar phases (month), and the changing seasons (year). These events are consistent and observable, making them reliable for measuring time.

Q.9: It is difficult to locate the meniscus in a wider vessel. Why?

Ans: In wider vessels, the meniscus is less pronounced and can be harder to see due to the curvature of the liquid surface. This makes it challenging to determine the exact level of the liquid, leading to potential measurement errors.

Q.10: Which instrument can be used to measure:
(i) Internal diameter of a test tube. (ii) Depth of a beaker.

Ans: (i) The internal diameter of a test tube can be measured using Vernier Calipers, which provide precise measurements.
(ii) The depth of a beaker can be measured using a ruler or a measuring tape, ensuring the measurement is taken vertically from the top to the bottom.

COMPREHENSIVE QUESTIONS

Q.1: What is meant by base and derived quantities? Give the names and symbols of SI base units.

Ans: Base quantities are fundamental physical quantities that cannot be expressed in terms of other quantities. They serve as the foundation for measuring various physical phenomena. In the International System of Units (SI), there are seven base quantities, each with a specific unit. These include:

- **Length (meter, m)**: The distance between two points. For example, the height of a person can be measured in meters.
- **Mass (kilogram, kg)**: The amount of matter in an object. A bag of sugar might weigh 1 kg.
- **Time (second, s)**: The duration of events. A minute is 60 seconds.
- **Electric current (ampere, A)**: The flow of electric charge. A typical light bulb might use 0.5 A.
- **Temperature (kelvin, K)**: A measure of thermal energy. Water freezes at 273 K.
- **Amount of substance (mole, mol)**: A quantity used in chemistry to count particles. One mole contains approximately 6.022×10^{23} particles.
- **Luminous intensity (candela, cd)**: The brightness of a light source. A standard candle emits about 1 cd.

These base units are essential for scientific measurements and calculations.

Q.2: Give three examples of derived units in SI. How are they derived from base units? Describe briefly.

Ans: Derived units are formed from the combination of base units and are used to measure more complex physical quantities. Here are three examples of derived units in SI:

- **Area (square meter, m^2)**: Area measures the extent of a surface. It is derived from the base unit of length. For example, if a rectangle has a length of 5 meters and a width of 3 meters, its area is calculated as length × width = 5 m × 3 m = 15 m^2.
- **Volume (cubic meter, m^3)**: Volume measures the space occupied by a substance. It is derived from length, as it involves three dimensions. For instance, a cube with each side measuring 2 meters has a volume of 2 m × 2 m × 2 m = 8 m^3.
- **Speed (meter per second, m/s)**: Speed measures how fast an object moves. It is derived from length and time. For example, if a car travels 100 meters in 5 seconds, its speed is calculated as distance/time = 100 m / 5 s = 20 m/s.

These derived units help quantify various physical properties in science and everyday life.

Q.3: State the similarities and differences between Vernier Calipers and micrometer screw gauge.

Ans: Vernier Calipers and micrometer screw gauges are both precision measuring instruments used to measure small lengths with high accuracy.

Similarities:

- Both instruments provide precise measurements and are commonly used in laboratories and workshops.
- They can measure internal and external dimensions, as well as depths.
- Both have a main scale and a secondary scale (Vernier scale for callipers and circular scale for micrometers) to enhance measurement accuracy.

Differences:

- **Measurement Range**: Vernier Calipers can measure larger dimensions (up to 15 cm or more), while micrometer screw gauges are typically used for smaller measurements (up to 2.5 cm).
- **Precision**: Micrometer screw gauges generally offer higher precision, often measuring to the nearest 0.01 mm, compared to Vernier Calipers, which usually measure to the nearest 0.1 mm.
- **Design**: Vernier Calipers have two jaws for measuring external and internal dimensions, while micrometers have a spindle and an anvil for measuring external dimensions only.

  These differences make each instrument suitable for specific applications in measurement tasks.

Q.4: Identify and explain the reasons for human errors, random errors, and systematic errors in experiments.

Ans: In scientific experiments, errors can occur due to various factors, which can be categorized into three main types: human errors, random errors, and systematic errors.

- **Human Errors**: These are mistakes made by the experimenter, often due to misreading instruments, recording data incorrectly, or not following procedures accurately. For example, if a student misreads the scale on a ruler, it can lead to incorrect measurements. Human errors can often be minimized through careful training and practice.
- **Random Errors**: These errors arise from unpredictable variations in measurements, such as fluctuations in temperature, pressure, or instrument sensitivity. For instance, if a thermometer gives slightly different readings due to environmental changes, this is a random error. These errors can be reduced by taking multiple measurements and averaging the results.
- **Systematic Errors**: These are consistent inaccuracies that occur due to faulty equipment or incorrect calibration. For example, if a balance scale is not zeroed properly, it will always give readings that are too high or too low. Systematic errors can be identified and corrected by calibrating instruments before use.

  Understanding these errors is crucial for improving the accuracy and reliability of experimental results.

Q.5: Differentiate between precision and accuracy of a measurement with examples.

Ans: Precision and accuracy are two important concepts in measurement that are often confused but have distinct meanings.

- **Precision** refers to the consistency of repeated measurements. It indicates how close the measurements are to each other, regardless of whether they are close to the true value. For example, if a student measures the length of a pencil three times and gets 10.1 cm, 10.2 cm, and 10.1 cm, the measurements are precise because they are very close to each other, even if they are not the actual length of the pencil.
- **Accuracy**, on the other hand, refers to how close a measurement is to the true or accepted value. For instance, if the actual length of the pencil is 10.0 cm and the student measures it as 10.1 cm, the measurement is accurate because it is very close to the true value. However, if the measurements were 9.5 cm, 9.6 cm, and 9.7 cm, they would be precise but not accurate, as they are far from the true length.

  In summary, precision is about consistency, while accuracy is about correctness. Both are essential for reliable measurements in science and engineering.

1. Calculate the number of second in a (a) day (b) week (c) month and state your answers using SI prefixes.

(a) day = $24 \times 60 \times 60 = 86.4$ ks
(b) week = 7×86.4 ks = 604.8 ks
(c) month = 30×86.4 ks = 2,592 Ms

2. State the answers of problem 1.1 in scientific notation.

Scientific notation:

a) 8.64×10^4 s,
b) 6.048×10^5 s c) 2.592×10^6 s

3. Solve the following addition or subtraction. State your answers in scientific notation.

(a) 4×10^4 kg + 3×10^3 kg = 43×10^3 kg
(b) 54×10^4 m - 3.2×10^3 m = 536.8×10^3 m

4. Solve the following multiplication or division. State your answers in scientific notation.

Multiplication/Division:

(a) $(5 \times 10^4 \text{ m}) \times (3 \times 10^{-2} \text{ m}) = 15 \times 10^2 \text{ m}^2$
(b) $(6 \times 10^8 \text{ kg})/(3 \times 10^4 \text{ m}^3) = 2.0 \times 10^4 \text{ kg m}^{-3}$

5. Calculate the following and state your answer in scientific notation.

$(3 \times 10^2 \text{ kg}) \times (4.0 \text{ km}) / (5 \times 10^2 \text{ s}^2) = 2.4 \times 10^3 \text{ kg m s}^{-2}$

6. State the number of significant digits in each measurement.
Significant digits:
(a) 0.0045 m = 2 significant digits
(b) 2047 m = 4 significant digits
(c) 3.40 m = 3 significant digits
(d) 3.420×10^3 m = 4 significant digits

7. Write in scientific notation:
Scientific notation:
(a) 0.0035 m = 3.5×10^{-3} m
(b) 2064×102 m = 2.064×10^5 m

8. Write using correct prefixes:
Correct prefixes:
(a) 5.0×10^7 cm = 500 km
(b) 580×10^3 g = 580 kg
(c) 45×10^{-3} s = 45 ms

9. Light year is a unit of distance used in Astronomy. It is the distance covered by light in one year. Taking the speed of light as 3.0 10 m s-¹, calculate the distance.
Light year calculation:
Speed of light = 3.0 × 108 m/s
Distance = speed × time = (3.0 × 108 m/s) × (365 × 24 × 60 × 60 s) = 9.46 × 1015 m

10. Express the density of mercury given as 13.6 g cm^{-3} in kg m^{-3}.
Express density of mercury: 13.6 g cm^{-3} = 1.36 × 104 kg m^{-3}

MULTIPLE CHOICE QUESTIONS

1. The instrument that is most suitable for measuring the thickness of a few sheets of cardboard is a:
A) meter rule B) measuring tape
C) Vernier Calipers D) micrometer screw gauge

2. One femtometre is equal to:
A) 10^{-9} m B) 10^{-15} m C) 109 m D) 10^{15} m

3. A light year is a unit of:
A) light B) time C) distance D) speed

4. Which one is a non-physical quantity?
A) distance B) density C) colour D) temperature

5. When using a measuring cylinder, one precaution to take is to:
A) check for the zero error
B) look at the meniscus from below the level of the water surface
C) take several readings by looking from more than one direction
D) position the eye in line with the bottom of the meniscus

6. Volume of water consumed by you per day is estimated in:

A) millilitre B) liter C) kilogram D) cubic meter

7. A displacement can is used to measure:

A) mass of a liquid B) mass of solid C) volume of liquid D) volume of solid

8. Two rods with lengths 12.321 cm and 10.3 cm are placed side by side, the difference in their lengths is:

A) 2.02 cm B) 2.0 cm C) 2 cm D) 2.021 cm

9. Four students measure the diameter of a cylinder with Vernier Calipers. Which of the following readings is correct?

A) 3.4 cm B) 3.475 cm C) 3.47 cm D) 3.5 cm

10. Which of the following measures are likely to represent the thickness of a sheet of this book?

A) 6×10^{-25} m B) 1×10^{-4} m C) 1.2×10^{-15} m D) 4×10^{-2} m

11. In a Vernier Calipers ten smallest divisions of the Vernier scale are equal to nine smallest divisions of the main scale. If the smallest division of the main scale is half millimeter, the Vernier constant is equal to:

A) 0.5 mm B) 0.1 mm C) 0.05 mm D) 0.001 mm

ANSWERS KEY

1	**C**	**2**	**A**	**3**	**A**	**4**	**C**	**5**	**D**
6	**B**	**7**	**C**	**8**	**B**	**9**	**B**	**10**	**A**
11	**C**								